A WASHING MACHINE FOR BOTH OIL AND WATER WASH HAVING SELF-DIAGNOSING AND NETWORKING FUNCTION

TECHNICAL FIELD

The present invention generally relates to a washing machine, and particularly to, a washing machine which can selectively perform a water-used washing and an oil-used washing by using one washing tub. The washing machine has a self-diagnosis function and a communication or networking function.

BACKGROUND ART

In general, the washing machines may be classified into a water-based washer using water as washing fluid and an oil-based washer using oil as the washing fluid. Since one type of the washing machine is normally exclusively used from the other, if the user wants both of the water-used washing and the oil-used washing, he cannot help purchasing all of these two kinds of washing machines. This costs much money and a large space. For this reason, industrial washing machines capable of performing all of these two kinds of washing have been proposed in recent years. However, the proposed washing machines still have many problems to be solved, e.g., a problem related to the efficiency of washing or an economic problem, etc., since a device for removing the oil remaining on the washing tub or a device for purifying the used oil has not been properly provided to them. Further, in the prior art washing machines, a home visit service by the product provider often has to be made for maintenance of the washing machine and for an emergency situation in which the washing machine cannot be abruptly operated. Especially, in case that the product provider is located far away from the user, it will take much time to normalize the washing machine. This results in reduction of the operation hour, reduction of the washing efficiency, and hence reduction of competitive power in the market. Therefore, a prompt effort is required to solve these problems.

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

The object of the present invention is to provide a washing machine which can selectively perform a water-used washing and an oil-used washing by using one washing tub and has a self-diagnosis function and a communication or networking function.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which a constant amount of detergent is feed under a constant level of pressure to thereby maximize the efficiency of the washing process

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which the water washing and the oil washing can be performed with respect to one washing tub by completely removing alien material and the oil remaining on the washing tub and deterioration of the laundry can be avoided, while providing economic benefits by using the oil reclaimed by a reclamation process.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which a soft-start control is applied to a fan motor at the time of an initial rotation thereof by being equipped with an inverter, thereby minimizing vibrations or shocks caused by the fan motor.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which the washing tub is initially rotated at a lower speed for a given time and then is rotated at a higher speed to prevent an imbalance problem of the laundry and to minimize rotational vibrations due to the eccentricity, thereby enabling the washing tub to perform a stable dehydration process in reduced noises and vibrations during the dehydration process.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which a reclamation unit is independently formed from the washing machine to increase an efficiency in installing process of the washing machine and to enable the reclamation unit to be applied to a number of washing machines or different types of washing machines.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function in which fins used in a heat exchanger are of a high-fin type to thereby provide a maximized efficiency in heat transfer and to reduce the mounting place thereof.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function which has a self-diagnostic function and an assisting function for assisting the user in performing maintenance.

Another object of the present invention is to provide a washing machine having the self-diagnosis function and the communication function which can perform a remote monitoring and communication through a connection to a PSTN.

TECHNICAL SOLUTION

The present invention is to provide a washing machine in which the water washing and the oil washing can be performed with respect to one washing tub by completely removing alien material and the oil remaining on the washing tub and a real time remote maintenance is achieved by using a main computer connected to the PSTN.

ADVANTAGEOUS EFFECTS

The present invention has an advantage in that both of the water washing and the oil washing can be performed with respect to one washing tub.

The present invention has an advantage in that a constant amount of detergent is feed in a constant level of pressure to thereby maximize the efficiency of the washing process

The present invention has an advantage in that deterioration of the laundry can be avoided, while providing economic benefits by completely removing alien material and the oil remaining on the washing tub.

The present invention has an advantage in that economic benefits such as saving of the operative costs can be resulted by using the oil reclaimed by a reclamation process.

The present invention has an advantage in that a soft-start control is applied to a fan motor at the time of an initial rotation thereof by being equipped with an inverter, thereby minimizing vibrations or shocks caused by the fan motor.

The present invention has an advantage in that the washing tub is initially rotated at a lower speed for a given time and then is rotated at a higher speed to

prevent an imbalance problem of the laundry and to minimize rotational vibrations due to the eccentricity, thereby enabling the washing tub to perform a stable dehydration process or a stable deoiling process in reduced noises and vibrations during the dehydration process or deoiling process.

The present invention has an advantage in that a reclamation unit is independently formed from the washing machine to increase an efficiency in installing process of the washing machine and to enable the reclamation unit to be applied to a number of washing machines.

The present invention has an advantage in that fins used in a heat exchanger are of a high-fin type to thereby provide a maximized efficiency in heat transfer and to reduce the mounting place thereof.

The present invention has an advantage in that it allows the maintenance to be easily and conveniently performed with its self-diagnostic function and assisting function for assisting the user in performing the maintenance.

The present invention has an advantage in that it can perform a wide area communication and maintenance through a connection to a PSTN.

DESCRIPTION OF DRAWINGS

The above and other objects and features of the present invention will become apparent from the following description of the embodiments provided in conjunction with the accompanying drawings.

Fig. 1 is a block diagram showing a configuration of a preferred embodiment of the present invention.

Fig. 2 is a diagram showing a configuration of a washing unit of the preferred embodiment of the present invention.

Fig. 3 is a diagram showing a first detergent supply of the washing unit shown in Fig. 2.

Fig. 4 is a diagram showing components performing the water-used washing of the washing unit shown in Fig. 2.

Fig. 5 is a diagram showing components performing the oil-used washing of the washing unit shown in Fig. 2.

Fig. 6 is a flow chart of a process for restoring or maintaining the washing

machine in accordance with the preferred embodiment of the present invention.

Fig. 7 is a diagram showing a configuration of a reclamation unit for purifying the oil, wherein the unit is in an independent form from the washing unit shown in Fig. 2.

BEST MODE

In accordance with one aspect of the present invention, a washing machine with a self-diagnostic function and a communication function comprises a washing tub for selectively performing a water washing or an oil washing depending on the laundry; a water supply for supplying water to the washing tub; an oil supply for supplying oil to the washing tub; a drainage for discharging the water or the oil contained in the washing tube to the outside; a first detergent supply mounted to the water supply to mix an amount of detergent in the water being supplied to the washing tub; and a second detergent supply mounted to the oil supply to mix an amount of detergent in the oil being supplied to the washing tub.

In accordance with another aspect of the present invention, the washing tub comprises a drying unit having a heater for heating an air to generate a hot air, and a fan motor equipped with an inverter and a fan for blowing the hot air into the washing tub, whereby the laundry in the washing tub after a washing process is dried by the hot air.

In accordance with another aspect of the present invention, the first detergent supply comprises a detergent tank for keeping therein detergent, a metering pump for feeding a constant amount of the detergent, and a safety relief valve for maintaining a pressure of an output side of the metering pump in a constant level.

In accordance with another aspect of the present invention, the water supply comprises a water conversion unit for a conversion of hard water into soft water.

In accordance with another aspect of the present invention, the water supply further comprises a first temperature control unit for adjusting temperature of the water being supplied into the washing tub to a level optimal to the washing.

In accordance with another aspect of the present invention, the washing machine further comprises a reclamation unit having a reclamation tank keeping therein wasted oil, a plurality of heat exchangers for previously heating the wasted oil and for liquidizing oil vapor, and an oil vaporizer for vaporizing the pre-heated oil to separate alien material from oil, wherein the reclamation unit is integrally formed with the washing machine or is formed in an independent form from the washing machine.

In accordance with another aspect of the present invention, said heat exchanger has a plurality of coolers for cooling the oil vapor reclaimed in the oil vaporizer step-by-step to liquidize the oil vapor, and a pre-heater for previously heating the oil to be reclaimed which is supplied from the reclamation tank and for previously cooling the reclaimed oil vapor to feed the oil vapor to the cooler through a heat exchange between the oil being introduced into the oil vaporizer and the oil vapor being discharged from the oil vaporizer, wherein heat transfer tubes used in the heat exchanger is of a high-fin type.

In accordance with another aspect of the present invention, the washing machine further comprises a communication system having a main computer for monitoring and controlling the washing machine in a real time to allow the user to solve a problem by himself under an assistance by a program for self-diagnosis in an emergency situation of the washing machine, and for performing a communication and a control through a connection to a PSTN, a touch panel (TFT-LCD) for displaying information in visual manner such as a graph or figures, a camera, a microphone and a speaker enabling the user to perform a real time maintenance through a visual and audible dialogue with a product provider or a technical expert in remote place based on MPEG4 technology, and a server connected to the main computer through the PSTN.

In accordance with another aspect of the present invention, said main computer transmits an alarm signal and information about a current state of the washing machine to a mobile terminal of the user by using a SMS (Short Message Service).

as shown in Fig. 1, the inventive washing machine M includes a washing unit W which is a hardware for performing a real washing operation, a control unit 600 for performing a control, an operation and a self-diagnosis, and a communication system 700 providing a visual audio communication function between the user and the product provider based on a wide area network technology.

As shown in Fig. 2, the washing unit W is provided with a washing tub 100 selectively performing the water-washing or the oil-washing, a water supply 200 for supplying water to the washing tub 100, an oil supply 300 for supplying oil to the washing tub 100, a drainage 400 for discharging the water or oil in the washing tub 100, and a reclamation unit 500 for reclaiming the contaminated oil after washing. The washing unit W is controlled by the control unit 600 and is also monitored and controlled by the communication system 700.

The washing tub 100 performs sequentially washing, rinsing, dehydration and drying in this order. The processes are performed inside the washing tub 100. The drying process is assisted by a drying unit 110 which exists outside the washing tub 100 and provides a hot wind.

It is preferable that the washing tub 100 be provided with a sensor (not shown) for detecting an unbalanced distribution of the laundry in the washing tub 100 during dehydration or deoiling.

As shown in Fig. 2, the drying unit 110 is provided with a heater 114 for heating the air, a fan motor 112 equipped with a fan 113 which introduces the hot wind into the washing tub 100 by its rotational force, and a hot-wind supply passageway 116 guiding the heated air, i.e., the hot wind, into an inner space of the washing tub 100.

Further, the drying unit 110 is also provided with a lint filter 118 for filtering alien material from oil vapor generating inside the washing tub 100 during the drying process, a condenser 119 for liquidizing the oil vapor having passed through the lint filter 118, and a separator 120 for separating water from the liquidized oil.

The oil from which water has been removed by the separator 120 is then fed to a second oil tank 334 of the oil supply 300, while the water component being discharged outside.

It is desirable that the fan motor 112 be operated in a soft-start manner in order to minimize vibrations or shocks which may damage the washing machine. This can be achieved by providing an inverter 111 to the fan motor 112.

As shown in Figs. 2 and 4, the water supply 200 is provided with a water supply line 210 and a first pump P1 which function to supply water to the washing tub 100 from the outside, and a first detergent supply unit 220 connected to the water supply line 210 to supply detergent to the water being supplied through the water supply line 210.

Further, the water supply 200 is provided with a water conversion unit 230 mounted on a leading portion of the water supply line 210 for a conversion of hard water being supplied into soft water by using ionization, an agitator 240 mounted

near the first detergent supply 220 and agitating the mixture of water and detergent for a well mixed state therebetween, and a first temperature control unit 250 for adjusting the temperature of the water being supplied into the washing tub 100 to a proper level.

The first detergent supply 220 supplies a determined amount of detergent in a constant level of pressure. As shown in Fig. 3, it has a detergent tank 222 for keeping therein detergent, a valve 223 mounted to the detergent tank 222 to serve as an exit for detergent, a metering pump 224 for discharging the determined amount of detergent into the water supply line 210, and a safety relief valve 226 and a solenoid valve 227 for preventing any variation and fluctuation of the flow rate by maintaining the pressure of an output side of the metering pump 224 in a constant level.

The first detergent supply 220 also has a fluctuation prevention unit 228 mounted to the output side of the metering pump 224 to prevent the flow of the detergent from fluctuating.

As shown in Figs. 2 and 5, the oil supply 300 is provided with an oil tank 330 for keeping therein the oil before/after the washing process, an oil supply line 310 connected to the oil tank 330 to supply oil to the washing tub 100, a second pump P2, and a second detergent supply 320 connected to the oil supply line 310 to supply detergent thereto.

The oil supply 300 is also provided with a second temperature control unit 340 for maintaining the temperature of the oil being supplied into the washing tub 100 in a proper level, a spin filter 350 for removing the laundry particles remaining after the washing process and the alien material which may be mixed with oil during the washing process, and a carbon filter 360 for filtering various odor components contained in oil.

The oil tank 330 has two tanks, i.e., a first oil tank 332 and a second oil tank 334. The oil before use or the reclaimed oil is contained in the first oil tank 332 and is supplied to the washing tub 100 later. The second oil tank 334 is for the oil from which water component is removed by the separator 120, the oil from which the odor components are removed by the carbon filter 360, and the oil reclaimed from the oil contained in a reclamation tank 510 of the reclamation unit 500 which serves to

reservoir therein the contaminated oil. The reclaimed oil of the second oil tank 334 is supplied to the first oil tank 332 again. The supply of the reclaimed oil from the second oil tank 334 to the first oil tank 332 is achieved when the reclaimed oil in the second oil tank 334 overflows, over an upper end wall of the first oil tank 332 which is adjacent to the second oil tank 334, into the first oil tank 332.

Because the second detergent supply 320 has a configuration similar to that of the first detergent supply 220, a detailed description of it will be omitted.

The drainage 400 includes a discharge line 410, connected to the washing tub 100, through which water or oil is discharged, a button trap 420 connected to the discharge line 410 to eliminate the alien material. The button trap 420 is equipped with a water discharge passageway 422 and an oil discharge passageway 424 through which water and oil are discharged, respectively, and a water vapor discharge passageway 426 and an oil vapor discharge passageway 428 through which water vapor and oil vapor, being generated from the drying process, are discharged, respectively.

The water vapor generated from the washing process is discharged outside through the water vapor discharge passageway 426, while the oil vapor generated in the washing tub 100 is flown to the drying unit 110 through the oil vapor discharge passageway 428.

The oil vapor introduced into the drying unit 110 is purified and liquidized by the lint filter 118 and the condenser 119. After that, it is fed to the separator 120 in which the water component is removed from it and then is contained in the second oil tank 334.

As shown in Fig. 2, the reclamation unit 500 includes the reclamation tank 510, a heat exchanger 520, an oil vaporizer 530 and a third pump P3.

The reclamation tank 510 reservoirs the contaminated oil to be reclaimed.

The heat exchanger 520 has a pre-heater 522, and a first and a second cooler 524, 526.

The pre-heater 522 is positioned between the reclamation tank 510 and the oil

vaporizer 530 and serves to previously heat the liquid oil before the liquid oil is fed to the oil vaporizer 530 in which the liquid oil is vaporized by steam. The pre-heater 522 also previously cools the reclaimed oil vapor being discharged from the oil vaporizer 530 in which the liquid oil is vaporized and then is reclaimed before the reclaimed oil vapor is introduced into the first cooler 524.

In other words, a heat exchange occurs between the liquid oil being introduced into the oil vaporizer 530 and the oil vapor being discharged from the oil vaporizer 530, so that the liquid oil to be reclaimed being supplied from the reclamation tank 510 is pre-heated, while the oil vapor is pre-cooled and then is fed to the first cooler 524.

This can assist the operation of the oil vaporizer 530 and the first and the second coolers 524, 526, thereby increasing the thermal efficiency.

The first cooler and the second cooler 524, 526 cool the oil vapor to change the phase of the oil vapor into the oil in liquid state by using heat transfer tubes 528 equipped within the first and the second coolers 524, 526. The second cooler 526 discharges the final reclaimed oil, which is fed to the second oil tank 334.

The first cooler 524 and the second cooler 526 are connected to each other through the third pump P3. The operation between them will be described later.

Meanwhile, it is preferable that the heat transfer tubes 528 used in the heat exchanger 520 be of a high-fin type which may provide a maximized efficiency in heat transfer and an easy piping work thereof and requires a reduced mounting place, thereby minimizing a spatial problem which may be resulted.

The oil vaporizer 530 vaporizes the introduced oil by using steam to separate the alien material from the oil and then the oil is fed to the pre-heater 522. It is desirable that the reclamation unit 500 be equipped with a level detector (not shown) for enabling an amount of the oil being treated to be adjusted to a proper level.

Meanwhile, as shown in Fig. 7, the reclamation unit 500 can be independently formed from the washing machine, although it may be integrally formed therewith. Independent formation of the reclamation unit 500 from the washing machine increases an efficiency in installing process of the washing

machine. Further, it enables the reclamation unit 500 to provide a number of washing machines with the reclaimed oil at one time and to be applied to different types of washing machines.

The control unit 600 includes a controller 610 controlling components of the washing machine based on a program for washing, an operating section 620 for running and changing the washing program, and a display 630 for informing the user of a current state of the washing machine.

The controller 610 controls the washing machine by itself, based on built-in programs for washing and self-diagnosis and, if necessary, it may be controlled by a communication system 700.

When an emergency situation occurs, the display 630 displays a problem report for every sections of the washing machine to thereby assist the user to understand the problem. After that, the user may normalize the washing machine through a manipulation of the operating section 620.

The communication system 700 performs communication based on a WAN (wide area network) through the internet and the PSTN (public switched telephone network) and functions as a system which performs a diagnosis and transmits video and audio information. The communication system 700 includes a main computer 710, a user's interface 720, and a product provider's server 730.

The main computer 710 can directly control the washing machine through the communication with the control unit 600. When it is connected to the PSTN, it is possible to perform a wide area communication with the washing machine provider or a technical expert. The wide area communication may be implemented based on MPEG 4.

Further, the main computer 710 has built-in programs classified by the washing courses, which can be edited. Further, it may perform a real time download of the programs for the washing process and then upload those programs to the control unit 600.

The interface 720 is provided with a touch panel (TFT-LCD) 722, a camera (CCD camera) 744, a microphone 746 and a speaker 748.

The touch panel 722 functions as an input/output means for the main computer 710 and provides an interactive real time communication function with the user.

The touch panel 722 may provide visual outputs in the form of graph or figure and various input interfaces such as key pads or touch screen.

The camera 724, the microphone 726 and the speaker 748 enable a visual and audible dialogue with the product provider or the technical expert in remote place. In implementing this, wire transmission or radio transmission can be properly selected under a consideration of functions or convenience.

The server 730 which is managed by the product provider in remote place is connected to the main computer 710 through the PSTN, so that it can receive information about the current state or the emergency situation of the washing machine. Further, the server 730 builds a database of the information, performs analysis, and determines future problems which may be issued. Therefore, it can inform the user of a proper solution for the problem and assist the user to establish a future maintenance plan.

Operations of the above described washing machine in accordance with the preferred embodiment of the present invention will be described in detail with classification into the water washing and the oil washing.

First of all, the water washing includes the washing → the rinsing → the dehydration → the drying in this order and detailed description thereof will be given hereunder with reference to Fig. 4.

In Fig. 4, a thick solid line indicates a water supply path, a thick dashed line indicates a water circulation path, a thin dash-dot line indicates a path of the hot wind, a thin dashed line means a path of the water vapor, and a thin solid line means a path of the liquid water.

The washing process is started in following manners. When the first pump P1 is switched on after opening of the main valve M/V and the solenoid valves SV21, SV22, SV12, water is supplied to the water supply line 210 from the outside. The

water being supplied in a state of hard water is changed into soft water by the water conversion unit 230 mounted to the leading portion of the water supply line 210.

Next, the first detergent supply 220 supplies the predetermined detergent to the water being introduced and the agitator 240 agitates the mixture of water with detergent for a well mixed state therebetween. Next, the temperature of the detergent-added water being introduced is adjusted to an optimal level by the first temperature control unit 250 and then the detergent-added water is fed to the washing tub 100.

When the washing tub 100 is charged with a predetermined amount of water, the solenoid valve SV21 is closed while the solenoid valve SV20 being opened. After that, while the washing tub 100 starts to rotate, the washing process begins.

In this process, the solenoid valve SV21 is closed to shut-off the water supply from the outside, whereas the solenoid valve SV20 is opened to establish a closed loop defined with the discharge line 410, the button trap 420 and the water supply line 210, through which the water contained in the washing tub 100 continuously circulates during the washing process.

After that, when the washing is completed, the wasted water charging the washing tub 100 is discharged by opening the solenoid valve SV19 or is forcibly discharged by opening the solenoid valve SV23 and by operating the first pump P1 at the same time.

Next, the rinsing process is started. Water is supplied into the washing tub 100 in a manner similar to that of the washing process. Although detergent is not supplied in the rinsing process, rinse is provided to prevent damage of the laundry (clothes) in the final round of the rinsing process.

Next, the dehydration is started. Like the washing process and the rinsing process, the water is discharged by opening the solenoid valve SV19 or is forcibly discharged by opening the solenoid valve SV23 and by operating the first pump P1 at the same time.

The dehydration is processed in two steps, i.e., a rotation of the washing tub 100 at a lower speed and a rotation of the washing tub 100 at a higher speed.

Initially, the washing tub 100 is rotated at a lower speed to give the laundry having an imbalance problem a chance to evenly redistribute in the washing tub 100, thereby allowing the washing tub 100 to be in balanced position. This is to minimize vibrations of the washing tub 100 due to its eccentric position at the time when the washing tub 100 is rotated at a high speed for an actual dehydration.

In the process, when a detection value of the sensor detecting a distributed state of the laundry in the washing tub 100 runs within a predefined range, the rotational speed of the washing tub 100 is changed to a high speed from a low speed.

Finally, the drying process is started. When the fan motor 112 is operated, outside air is introduced into the drying unit 110 by the fan 113 and then is heated by the heater 114.

The hot wind generated by heating is introduced into the washing tub 100 through the hot wind supply passageway 116 to dry the laundry. The water vapor being generated in this process is discharged outside through the water vapor discharge passageway 426.

Soft-start control is applied to the fan motor 112 at the time of initial rotation thereof by being equipped with the inverter 111 allowing an easy control of the speed. As a result, influences by the factors resulting in physical fatigue, i.e., vibrations or shocks can be minimized.

Now, operations of the washing machine performing the oil washing in accordance with the preferred embodiment of the present invention will be explained in detail with reference to Fig. 5.

In Fig. 5, a thick solid line indicates an oil supply path, a thick dashed line indicates an oil circulation path, a thin dash-dot line indicates a path of the hot wind, a thin dashed line means a path of the oil vapor, and a thin solid line means a path of the liquid oil.

First of all, the oil washing includes the washing → the deoiling → the drying → the oil vaporizing in this order.

The washing process is started in following manners. When the second

pump P2 mounted to the oil supply line 310 is switched on after opening of the solenoid valve SV1 mounted to the first oil tank 332, the oil contained in the first oil tank 332 is supplied to the oil supply line 310. The oil is supplied to the washing tub 100 through the second detergent supply 320, the second temperature control unit 340 and the solenoid valves SV9, SV13.

When the washing tub 100 is charged with a predetermined amount of oil, the solenoid valve SV1 is closed while the solenoid valve SV8 being opened. After that, while the washing tub 100 starts to rotate, the washing process begins. As shown in Fig. 5, the oil contained in the washing tub 100 continuously circulates during the washing process, through a closed loop defined with the button trap 420, the second temperature control unit 340, the spin filter 350 and the solenoid valve SV 11.

At the moment, the solenoid valve SV9 is closed.

After the completion of the washing process using oil, the rotation of the washing tub 100 is stopped, the wasted oil in the washing tub 100 is contained in the reclamation tank 510 through the discharge line 410, the button trap 420, and the solenoid valves SV18, SV3.

The deoiling process is for removing the oil component remaining on the laundry by rotating the washing tub 100 at a high speed. The oil being removed is discharged to the reclamation tank 510.

The deoiling is processed in two steps, i.e., a rotation of the washing tub 100 at a lower speed and a rotation of the washing tub 100 at a higher speed. Initially, the washing tub 100 is rotated at a lower speed to give the laundry having an imbalance problem a chance to evenly redistribute in the washing tub 100, thereby allowing the washing tub 100 to be in balanced position. This is to minimize vibrations of the washing tub 100 due to its eccentric position at the time when the washing tub 100 is rotated at a high speed for an actual deoiling.

In the process, when a detection value of the sensor detecting a distributed state of the laundry in the washing tub 100 runs within a predefined range, the rotational speed of the washing tub 100 is changed to a high speed from a low speed.

After the deoiling process, the drying process for removing the oil component

remaining on the laundry and the washing tub 100 is performed.

The drying process is achieved in such a way that, when the fan motor 112 is operated, the air having been heated by the heater 114 in the drying unit 110 is introduced into the washing tub 100 by the rotation of the fan 113 through the hot wind supply passageway 116.

The oil vapor being generated in this process circulates along the path indicated with the thin dash-dot line in Fig. 5.

At the moment, the hot wind heated by the heater 114 vaporizes the oil component remaining in the button trap 420 and then returns to the drying unit 110.

Soft-start control is applied to the fan motor 112 at the time of initial rotation thereof by being equipped with the inverter 111 allowing an easy control of the speed. As a result, influences by the factors resulting in physical fatigue, i.e., vibrations or shocks can be minimized.

The alien material is removed from the oil vapor introduced into the drying unit 110 through the oil vapor discharge passageway 428 by the lint filter 118. The oil vapor is then liquidized by the condenser 119. After that, removing the water component from the liquid oil is performed at the separator 120 and the oil is fed to the second oil tank 334, while the water component being discharged outside.

An actual washing operation is completed by finishing the washing process, the deoiling process, and the drying process. The reclamation process in which the oil wasted in the washing process is reclaimed for a future use is performed in following manners.

First, the heat exchanger 520 and the oil vaporizer 530 are vacuumed by the operation of the third pump P3 connected to the first and the second coolers 524, 526 in order to introduce the oil contained in the reclamation tank 510 into the oil vaporizer 530 via the pre-heater 522.

The oil being introduced into the oil vaporizer 530 is vaporized by steam circulating the oil vaporizer 530, being separated from the alien material and the oil vapor being vaporized enters the first cooler 524 through the pre-heater 522.

Water-cooling type first and the second coolers 524, 526 liquidize the oil vapor having a high temperature, wherein the oil initially cooled in the first cooler 524 is overflowed into the second cooler 526 and is secondly cooled in the second cooler 526. After that, the cooled oil which has been treated by the reclamation process is discharged to be fed to the second oil tank 334.

When the oil level in the second oil tank 334 arrives at a predefined level, the oil overflows into the first oil tank 332.

As shown in Fig. 7, if the reclamation unit 500 is separately formed from the washing unit W, it is desirable that the reclamation unit 500 be equipped with a separate reservoir (not shown) for containing therein the reclaimed oil.

Further, it is desirable that the oil vaporizer 530 be equipped with a funnel 532 which can be used to introduce the oil to be reclaimed through a different path.

The operations described above or the washing operation is performed by the control unit 600 according to the programs for the washing operation restored in the controller. It may be performed by the main computer 710 monitoring the washing unit W in real time via the control unit 600.

Meanwhile, since the main computer 710 is connected to the server 730 through the PSTN, it can transmit the information about the current state and use-history of the washing unit W to the server 730 to assist the technical expert to establish the future maintenance plan and hence the schedule therefor. The main computer 710 can download from the server 730 the information analyzed by the server, the information about the inspection schedule and updated programs for the washing process and upload those to the control unit 600.

If an emergency situation or a situation requiring a maintenance occurs to the washing unit W performing a normal operation in a manner described above, an audio alarm signal is emitted, while the information related to the alarm being displayed in the display 622 of the operating section 620, by the self-diagnostic function of the control unit 610. In case of a simple problem, a help program for solving the problem is triggered by the self-diagnostic function.

The user may normalize the washing machine M by himself by solving the problem or by performing the maintenance under the guidance by the help program.

However, in case those serious problems occur to the whole washing machine M, the information about that situation is displayed in the touch panel 722 of the interface 720 and at the same time a mobile terminal of the user is informed of the information about the washing machine M as well as the emergency situation. Further, a help program for performing the self-diagnostic function or for solving the problem may be run.

During the process, informing the mobile terminal of the occurrence of the emergency situation may be implemented by a SMS (Short Message Service). This alarm function may be selectively activated by the user. Further, the user may be informed of the information or alarms from a plurality of washing machine M.

If the user who is trying to solve the problem occurring to the washing machine M under an assistance by the self-diagnosis program fails to solve the problem in this manner, he can have a real time talk with the product provider or the technical expert in remote place in audible or visual manner through the PSTN in order to restore the washing machine M.

At the moment, the user performs the remote communication by using the camera 724, the microphone 726, the speaker 728 and the touch panel 722.

Meanwhile, the server 730 builds the database of the information, performs analysis about that, and determines future problems which may be issued. Therefore, it can inform the user of a proper solution for the problem and assist the user to establish a future maintenance plan.

INDUSTRIAL APPLICABILITY

While the present invention has been shown and described herein with respect to the particular embodiments, those skilled in the art will recognize that many exchanges and modifications may be made without departing from the scope of the invention as defined in the appended claims.